

Amendments to the Claims

This listing of the Claims will replace all prior versions and listings of the claims in this patent application.

Listing of the Claims

1-44. (canceled)

45. (original) A semiconductor device structure, comprising:

semiconductor devices formed on a semiconductor substrate, with an overlaying interconnecting metallization structure connected to said devices and comprising a plurality of first metal lines, and having a passivation layer formed thereover, with first openings in said passivation layer to contact pads connected to said first metal lines, wherein said first openings are as small as 0.1 μm ; and

a top metallization system formed in said openings and over said passivation layer, connected to said interconnecting metallization structure, wherein said top metallization system comprises a plurality of top metal lines, in one or more layers, having a thickness substantially greater than said first metal lines.

46. (original) The structure of Claim 45 wherein a first metal layer of said top metallization system comprises:

- a thin adhesion layer, in said first openings and over said passivation layer;
- a thin seed layer, formed over said thin adhesion layer; and
- a thick metal layer formed over said seed layer.

47. (original) The structure of Claim 46, further comprising a cap layer formed over said thick metal layer.

48. (original) The structure of Claim 47, wherein said cap layer comprises nickel (Ni).

49. (previously presented) The structure of Claim 46 wherein said thin adhesion layer is selected from the group comprising titanium tungsten (TiW), chromium (Cr), titanium (Ti), palladium (Pd), nickel (Ni) and titanium nitride (TiN), and has a thickness of between about 0.01 and 3 microns.

50. (previously presented) The structure of Claim 46 wherein said thin seed layer is selected from the group comprising copper (Cu), palladium (Pd), nickel (Ni) and gold (Au), and has a thickness of between about 0.05 and 3 microns.

51. (previously presented) The structure of Claim 46 wherein said thick metal layer is selected from the group comprising copper (Cu), palladium (Pd), nickel (Ni) and gold (Au), and has a thickness of between about 2 and 100 microns.

52. (previously presented) The structure of Claim 48 further comprising additional second and subsequent metal layers, each of said additional metal layers comprising a next thick metal layer formed over a next thin seed layer and a next thin adhesion layer.

53. (previously presented) The structure of Claim 52 wherein said next thick metal layer is selected from the group comprising copper (Cu), palladium (Pd), nickel (Ni) and gold (Au), and has a thickness of between about 2 and 100 microns.

54. (original) The structure of Claim 45 wherein said top metal lines are formed of pure aluminum.

55. (original) The structure of Claim 45 wherein said top metal lines are formed of a material selected from the group comprising copper (Cu), gold (Au), palladium (Pd) and nickel (Ni).

56. (original) The structure of Claim 45, wherein said top metallization system comprises metal lines formed to a thickness of between about 2 and 1000 times thicker than metal lines in said interconnecting metallization structure, and formed to a width of between about 2 and 1000 times the width of metal lines in said interconnecting metallization structure.

57. (original) The structure of Claim 45 further comprising a polymer insulating layer formed over said passivation layer, wherein second openings in said polymer insulating layer are formed over and which are larger than said first openings.

58. (original) The structure of Claim 57 wherein said polymer insulating layer is formed of a material selected from the group comprising polyimide, BCB, paralyne, parylene and elastomer.

59. (original) The structure of Claim 45 further comprising intermetal polymer layers, formed between said top metal lines, to a thickness of between about 2 and 30 microns.

60. (original) The structure of Claim 59 wherein said intermetal polymer layers are thicker than intermetal dielectric layers formed in said interconnecting metallization structure by a ratio of between about 2 and 500.

61. (original) The structure of Claim 57 wherein said intermetal polymer layers are formed of a material selected from the group comprising polyimide, BCB, paralyne, parylene and elastomer.

62. (original) A semiconductor device structure, comprising:

semiconductor devices formed on a semiconductor substrate, with an overlaying interconnecting metallization structure connected to said devices and comprising a

plurality of first metal lines, and having a passivation layer formed thereover, with first openings in said passivation layer to contact pads connected to said first metal lines, wherein said first openings are as small as 0.1 μm ; and

a top metallization system formed in said first openings and over said passivation layer, connected to said interconnecting metallization structure, wherein said top metallization system comprises a plurality of top metal lines, in one or more layers, having a thickness substantially greater than said first metal lines;

wherein said top metal lines comprise gold (Au) over a titanium tungsten (TiW) underlayer.

63. (original) A semiconductor device structure, comprising:

semiconductor devices formed on a semiconductor substrate, with an overlaying interconnecting metallization structure connected to said devices and comprising a plurality of first metal lines, and having a passivation layer formed thereover, with first openings in said passivation layer to contact pads connected to said first metal lines, wherein said first openings are as small as 0.1 μm ; and

a top metallization system formed in first said openings and over said passivation layer, connected to said interconnecting metallization structure, wherein said top

metallization system comprises a plurality of top metal lines, in one or more layers, having a thickness substantially greater than said first metal lines;

wherein said top metal lines comprise plated copper (Cu) over a copper seed layer formed over a chromium (Cr) underlayer, and wherein said plated copper is covered with a nickel (Ni) cap layer.

64. (previously presented) The structure of Claim 46 wherein said next thin adhesion layer is selected from the group comprising titanium tungsten (TiW), chromium (Cr), titanium (Ti), palladium (Pd), nickel (Ni) and titanium nitride (TiN), and has a thickness of between about 0.01 and 3 microns.

65. (previously presented) The structure of Claim 46 wherein said next thin seed layer is selected from the group comprising copper (Cu), palladium (Pd), nickel (Ni) and gold (Au), and has a thickness of between about 0.05 and 3 microns.

66. (previously presented) The structure of Claim 46, further comprising a cap layer formed over said next thick metal layer.

67. (previously presented) The structure of Claim 66, wherein said cap layer comprises nickel (Ni).

68. (previously presented) The structure of Claim 62, further comprising a cap layer formed over said thick metal layer.

69. (previously presented) The structure of Claim 68, wherein said cap layer comprises nickel (Ni).

70. (previously presented) The structure of Claim 62, wherein said top metallization system comprises metal lines formed to a thickness of between about 2 and 1000 times thicker than metal lines in said interconnecting metallization structure, and formed to a width of between about 2 and 1000 times the width of metal lines in said interconnecting metallization structure.

71. (previously presented) The structure of Claim 62 further comprising a polymer insulating layer formed over said passivation layer, wherein second openings in said polymer insulating layer are formed over and which are larger than said first openings.

72. (previously presented) The structure of Claim 71 wherein said polymer insulating layer is formed of a material selected from the group comprising polyimide, BCB, paralyne, parylene and elastomer.

73. (previously presented) The structure of Claim 62 further comprising intermetal polymer layers, formed between said top metal lines, to a thickness of between about 2 and 30 microns.

74. (previously presented) The structure of Claim 73 wherein said intermetal polymer layers are thicker than intermetal dielectric layers formed in said interconnecting metallization structure by a ratio of between about 2 and 500.

75. (previously presented) The structure of Claim 73 wherein said intermetal polymer layers are formed of a material selected from the group comprising polyimide, BCB, paralyne, parylene and elastomer.

76. (previously presented) The structure of Claim 63, wherein said top metallization system comprises metal lines formed to a thickness of between about 2 and 1000 times thicker than metal lines in said interconnecting metallization structure, and formed to a width of between about 2 and 1000 times the width of metal lines in said interconnecting metallization structure.

77. (previously presented) The structure of Claim 63 further comprising a polymer insulating layer formed over said passivation layer, wherein second openings in said polymer insulating layer are formed over and which are larger than said first openings.

78. (previously presented) The structure of Claim 77 wherein said polymer insulating layer is formed of a material selected from the group comprising polyimide, BCB, paralyne, parylene and elastomer.

79. (previously presented) The structure of Claim 63 further comprising intermetal polymer layers, formed between said top metal lines, to a thickness of between about 2 and 30 microns.

80. (previously presented) The structure of Claim 79 wherein said intermetal polymer layers are thicker than intermetal dielectric layers formed in said interconnecting metallization structure by a ratio of between about 2 and 500.

81. (previously presented) The structure of Claim 79 wherein said intermetal polymer layers are formed of a material selected from the group comprising polyimide, BCB, paralyne, parylene and elastomer.

82. (new) A semiconductor device structure, comprising:

semiconductor devices formed on a semiconductor substrate, with an overlaying fine line interconnecting metallization structure connected to said devices and comprising a plurality of first metal lines in one or more layers, and having a passivation layer formed thereover, with first openings in said passivation layer to contact pads connected to said first metal lines, wherein said first openings are as small as 0.1 μm ; and

a post-passivation metallization system formed in said first openings and over said passivation layer, connected to said fine line interconnecting metallization structure,

wherein said post-passivation metallization system comprises a plurality of top metal lines, in one or more layers, having a resistance times capacitance smaller than a resistance times capacitance of said fine line interconnecting metallization structure, wherein said top metal lines comprise a different material than said first metal lines.

83. (new) The structure of Claim 82 further comprising a polymer insulating layer formed over said passivation layer, wherein second openings in said polymer insulating layer are formed over said first openings and wherein said second openings are larger than said first openings.

84. (new) The structure of Claim 83 wherein said polymer insulating layer is formed of a material selected from the group comprising polyimide, BCB, paralyne, parylene and elastomer.

85. (new) The structure of Claim 82 further comprising silicon dioxide intermetal dielectric layers, formed between said first metal lines under said passivation layer and further comprising intermetal polymer layers, formed between said top metal lines over said passivation layer, to a thickness of between about 2 and 30 microns.

86. (new) The structure of Claim 85 wherein said intermetal polymer layers over said passivation layer are thicker than said intermetal dielectric layers under said passivation layer by a ratio of between 2 and 500.

87. (new) The structure of Claim 83 wherein said intermetal polymer layers are formed of a material selected from the group comprising polyimide, BCB, paralyne, parylene and elastomer.

88. (new) The structure of Claim 82 wherein said first metal lines are formed of aluminum and wherein said top metal lines are formed of a material selected from the group comprising copper (Cu), gold (Au), palladium (Pd) and nickel (Ni).

89. (new) The structure of Claim 82 wherein said first metal lines are formed of copper (Cu) and wherein said top metal lines are formed of a material selected from the group comprising gold (Au), palladium (Pd) and nickel (Ni).

90. (new) The structure of Claim 82 wherein each metal layer of said post-passivation metallization system comprises:

- a thin adhesion layer, in said first openings and over said passivation layer;
- a thin seed layer, formed over said thin adhesion layer; and
- a thick metal layer formed over said seed layer.

91. (new) The structure of Claim 90 wherein said thin adhesion layer is selected from the group comprising titanium tungsten (TiW), chromium (Cr), titanium (Ti), palladium (Pd), nickel (Ni) and titanium nitride (TiN), and has a thickness of between about 0.01 and 3 microns.

92. (new) The structure of Claim 90 wherein said thin seed layer is selected from the group comprising copper (Cu), palladium (Pd), nickel (Ni) and gold (Au), and has a thickness of between about 0.05 and 3 microns.

93. (new) The structure of Claim 90 wherein said thick metal layer is selected from the group comprising copper (Cu), palladium (Pd), nickel (Ni) and gold (Au), and has a thickness of between about 2 and 100 microns.